

**VASIL NIBAK**



# **CHERNOBYL:** truth and inventions

## 61

6





The accident in Chernobyl  
pales into insignificance  
before what the explosion  
of what today is considered  
to be the smallest nuclear bomb  
can entail.

But stockpiled in the world  
are scores of thousands of nuclear  
warheads, and each of them,  
just one, can produce  
a disaster whose scope  
simply cannot be imagined.

MIKHAIL GORBACHEV

VASIL NIBAK

# CHERNOBYL: truth and inventions

Kiev  
Politvidav Ukraini Publishers  
1987



This illustrated booklet describes the tragic events of April 26, 1986 when the world's worst ever nuclear power station accident at Chernobyl, Kiev Region, Ukraine made tens of thousands of people leave their homes in fear of the invisible yet deadly enemy. Using witness accounts and a wealth of factual material, the author vividly recreates the atmosphere of the first days after the breakdown with their anxiety and selfless heroism, and of the recovery operations which have no precedent in history.

Translated by  
Valentin Markelov

The twentieth century is often called the Nuclear Age. Discoveries in nuclear physics have played and continue to play a major role in the development of civilization. The rapid advancement of nuclear power engineering is particularly tangible.

Sometimes a question arises: Aren't the risks of using atomic energy for peaceful purposes too high? Indeed, who can guarantee safety when the fuel used in nuclear reactors is powerful enough to kill everything alive? The recent accidents at nuclear power stations have once again called the danger of a nuclear catastrophe to mind. Popular distrust of nuclear facilities used for peaceful purposes has grown considerably all over the world.

Yet, will it be reasonable to let all achievements in this important field lapse into oblivion because of several accidents, grave as they were? Today, it has become clear as never before that the peaceful atom requires a very special approach and handling. Running a nuclear power station calls for the highest responsibility on the part of all concerned—from the statesmen and scientists determining the strategy of nuclear power engineering to every construction worker and operator directly in charge of the safe functioning of a nuclear reactor.

Appeals to stop building nuclear power stations have become the order of the day. But is atomic energy the only source of risk and danger? Is chemical production absolutely harmless? In 1947, an accident in Texas City, USA proved the reverse when an ammonium nitrate explosion left 576 dead and some 2,000 wounded. In 1979, two trains loaded with liquid fuel, petrochemicals and chlorine collided near Toronto, Canada, and 250,000 people were evacuated from the contaminated area. Now who has counted the victims



of all air and sea disasters? Reports appear almost daily in the news, but is it always possible to prevent an accident?

Tragedies of the past as well as the recent explosion of liquid gas tanks near Mexico City which killed more than 400 people on the spot, the lethal gas leakage at the Union Carbide chemical plant in Bhopal, India, and the accidents at the Three Mile Island and Chernobyl nuclear power stations in no way mean that man should stop using either gas and oil or nuclear power for his needs. However, only the strictest observance of the operating procedure and safety rules, which would make negligence impossible, can guarantee safe peaceful use of the atom and preclude tragedies for both individuals and entire nations.

---

### THE BREAKDOWN

At 1:23 a. m. on April 26, 1986, the radioactivity gauges at Power Unit No. 4 of the Chernobyl Atomic Power Station registered a sudden increase. There was a considerable emission of steam, a reaction that led to the formation of hydrogen, an explosion, the destruction of the reactor and a venting of radioactivity.

The day before, an experiment was scheduled at one of the turbogenerators with the purpose of determining the extent to which mechanical energy of the rotor could keep that particular unit running in case of a sudden power failure. In other words, the plant management had planned a purely electrical engineering test which, if properly organized and carried out, would have had nothing to do with the actual reactor. However, irresponsibility and carelessness of the personnel resulted in a complete breakdown of Unit No. 4.

Later, the investigation would reveal the low quality of the experiment program which failed to provide for even the basic safety measures. At 2:00 p. m. on April 25, the emergency cooling system of Reactor No. 4 was cut off, and those responsible for the experiment were about to proceed with it. However, in compliance with instructions from a controller at Kievenergo (Kiev power supply authority), the shutdown of the reactor was postponed, and so it remained in operation till 1:23 a. m. of April 26, its emergency cooling switched off. Besides, a number of the reactor's technological protection systems was switched off, which was a gross infraction of safety rules.

That was when the irreparable happened. The atom broke out of man's control and became his enemy, powerful, insidious and invisible. The steam explosion partially destroyed the structural elements of the building and damaged the reactor, which resulted in a venting of radioactive fission products to the atmosphere and beyond the boundaries of the APS. The force of the blast was so great that the radioactive materials were blown to an altitude of nearly one kilometer. Burning debris soared above the reactor. Some fell on the roof of the engine room. A fire began.

---

### THE HEROES

It is believed that a mission is the hardest to accomplish when the extent of the required coincides with the limits of the possible. In case of battling a nuclear fire, one can say without a second thought: the extent of the required here is far beyond the capability of man.

In these dramatic circumstances, the people of Chernobyl proved capable of genuine heroism.

It was the first time in history that such a large-scale operation had to be carried out in the conditions of a permanent invisible, impalpable threat to everything alive, where an instantaneous response to change of the situation, unerring deployment of human and material resources and lightning speed of action acquired paramount importance.

The personnel of Fire Station No. 2 of the Chernobyl APS were among the first to stand in the way of radioactive death. It was to have been a routine working day for the firemen. Lieutenant Volodimir Pravik was in charge of Team No. 3, then on duty at the APS. In the afternoon the men had a class of theory and some practical training. Afterwards some played football, others watched TV.

On hearing the alarm, Pravik's team rushed to the scene of the accident. They were the first to grapple with fire.

The interval between the blast and the fire alarm was one minute only. At 1:30 a. m., Pravik's fire engine reached the station area. Approaching Power Unit No. 4, he noticed tongues of flame on the roofs of the engine room, the reactor and the auxiliary unit. Having assessed the situation, he deployed his team.

And yet he still could not imagine the full scope of the disaster.



There was a direct threat of fire destroying the total roof area over the engine room which housed all eight turbo-generators. The roof of the reactor building was already burning, the fire spreading fast. The firemen had to concentrate on those two areas first.

Under such complicated conditions, Volodimir Pravik displayed high professional competence and great courage. His decisions were timely and correct. Having lost not a single second, his men threw themselves into the deadly blaze. By then, they all had seen enough to realize that the reactor was damaged, with all the consequences. None of them stopped to think if the danger exceeded his duty. And the situation was aggravating by the minute.

A huge area was already on fire and shrouded in suffocating smoke. Boiling bitumen burned through their boots and splashed on their robes, eating into the skin. Exhausted by the smoke, heat and pain, the firemen were straining themselves to the utmost, the invisible enemy taking away the last of their strength.

The situation demanded that the fire be extinguished promptly in several places at various heights all over the reactor building. All firehazardous places inside the building had to be taken under control too, and new fires prevented. The maneuvering was extremely difficult.

1:35 a. m. Volodimir Pravik and his team had fought the fire alone for five minutes when help arrived from town—a fire brigade with Lieutenant Viktor Kibenok in charge. The roof of the engine room and the control center was still in flames.

Kibenok led an anti-gas and smoke protection team in reconnoitering the premises adjacent to the reactor's active zone. The radiation level was very high there. Having correctly deployed his force, Kibenok ensured continuous supply of water to the burning roof of the engine room. His firemen checked the spreading of fire towards Power Unit No. 3.

Having stayed in the high radiation area for a long time, Viktor Kibenok had to be evacuated from the operation zone and, later, hospitalized in Moscow. We can only guess what stood behind the laconic entry in the fire brigade's operations logbook: "...reconnoitered the premises adjacent to the reactor's active zone." One thing is certain, though: no one, never, and nowhere had in time of peace approached the invisible death so closely before him.

1:46 a. m. Major Leonid Telyatnikov, head of the fire

station, arrived at the APS. It was the last day of his vacation. On receiving information of the accident he did not hesitate a second but called out a service car and went to the scene even though he was without a protection suit. Later, in a Moscow clinic, he would write: "I came to the station from the side opposite to where the men were fighting the fire, and saw the crater in the damaged reactor, and on top of it, open to its lethal rays, were my friends. My blood froze. I could clearly see the damage the blast did to the power unit. The roof of the engine room was burning in several places at various heights from the ground—from 12.5 meters to 71.5 meters. I climbed an emergency ladder to the roof. Fireman Prishchepa reported that the situation was being brought under control."

Telyatnikov also wrote that his work as leader in extinguishing the fire was greatly facilitated by the highly professional actions of his subordinates. The fire fighters themselves quickly assessed the changes in the situation and concentrated on the critical areas. It was their self-dependence in handling the situation that, in the final analysis, played the decisive role.

At 3:22 a. m. the special fire brigade of the Kiev Region Executive Committee arrived on the scene. By that time the extinguishing of the fire over the engine room and the cooling of destroyed structural elements was in full progress, but radiation, the invisible enemy, continued its underhand work, adding new names to the casualty list.

The newly arrived fire brigades from Chernobyl, Poleskoye, Ivankov and other places in Kiev Region were committed. All in all, 37 fire-fighting units took part in the operation, and by 4:00 a. m. 81 fire engines and 186 firemen had been assembled around the APS to counter possible new fires.

At 4:50 the fire was localized. By 6:35 the last sparks had died away. The threat of further aggravation of the situation was warded off, the spreading of fire to the neighboring units prevented.

Who were those heroes that stood fearlessly in the way of the roaring nuclear firestorm? Only yesterday no one but their relatives and friends knew these simple people, but here they come and take the full burden of an enormous responsibility and save thousands of lives, without the slightest thought of saving their own... All the 28 fire fighters who were the first to arrive on the scene displayed outstanding fortitude and professionalism: Volodimir Pravik,



Viktor Kibenok, Leonid Telyatnikov, Mikola Vashchuk, Vasil Ignatenko, Volodimir Tishchura, Mikola Titenok, Boris Ali-shayev, Ivan Butrimenko, Mikhailo Golovenko, Andriy Korol, Anatoly Zakharov, Stepan Komar, Mikhailo Krysko, Viktor Legun, Serhiy Legun, Anatoly Naidiuk, Mikola Nechiporenko, Volodimir Palagecha, Olexandr Petrovsky, Petro Pivovar, Andriy Polovinkin, Volodimir Olexandrovich Prishchepa, Volodimir Ivanovich Prishchepa, Mikola Rudeniuk, Grigori Khmel, Ivan Shavrey, Leonid Shavrey.

Different men, different characters, habits and hobbies. But there was also much common in them all — moral integrity and readiness to help and sacrifice, high level of professional skill and professional pride, loyalty to duty and genuine patriotism.

The very way these gallant men and many other firemen had lived and worked before that night made them prepared for a feat of courage. There, in the fire, no one remembered about himself. Vasil Ignatenko felt that he had received an enormous dose of radiation, but only after he had carried six APS employees outside did he leave his post. That was the way all of them acted.

For one hour and twenty minutes Volodimir Pravik stayed in the zone of lethal radiation. Viktor Kibenok led his men into the flames by personal example, and his courage inspired others. Very well aware of what awaited them, both these officers resolutely continued to perform their duties to the last.

For personal courage, heroism and selfless execution of duty displayed in the course of the recovery operation following the accident at the Chernobyl APS, Volodimir Pravik and Viktor Kibenok were posthumously awarded the titles of Heroes of the Soviet Union.

A terrible ordeal fell to the lot of the APS personnel.

Volodimir Shashenok, adjuster of automation systems, and Valery Khodamchuk, operator, were killed instantaneously at the moment of the explosion. In fact, all the shift were caught in the epicenter of the atomic storm. Realizing that the breakdown they had to handle somehow had no precedent and no instruction book would tell them what to do, they all did what they could to localize the fire and save the station from further destruction.

Lidia Andreyeva, chemical water treatment section operator, did not leave her post for 12 hours, ensuring a continuous supply of desalinated water for cooling the reactor.

O. Vasilenko, who was in charge of the shift that day, stayed at the plant for 20 hours. His personal example inspired others for quick resolute action. Employee N. Khimach recalled later: "In the weeks that passed after the accident we lost several of our friends to whose lot the first blow fell. Anatoly Kurguz, central control board senior operator, died of sustained burns. He had succeeded in sealing the airtight door to the passage where the fire was coming from, but it cost him his life.

"All these people are no longer among us, but their memory will live forever in our grateful hearts."

The self-sacrificing heroism of the firemen and station personnel prevented further development of the accident, possibly saving tens of thousands of lives.

Defeating the fire whose destructive power was increased manifold by the deadly effect of radiation was one of the most important stages in eliminating the consequences of the breakdown. It did not last long, but the physical and mental strain on the part of all engaged in it made each minute equal to a year.

---

## THE DAYS OF ANXIETY

From the very first days of struggle against the atom in Chernobyl, the CPSU Central Committee, the USSR Council of Ministers and Party and government bodies of Ukraine and Byelorussia closely monitored the developments, taking energetic steps to mobilize manpower and material resources and eliminate the consequences of the breakdown in the shortest possible time. Vital decisions were made promptly and without delay. They determined the strategy and tactics of the operations to be performed by workers, engineers, scientists and army units.

The Governmental Commission was immediately formed with Boris Shcherbina, Deputy Chairman of the USSR Council of Ministers, at its head. The Commission included prominent scientists and experts from various ministries. At various stages the Commission was headed by Deputies Chairman of the USSR Council of Ministers I. Silayev, L. Voronin, Yu. Masliukov, V. Gusev, G. Vedernikov and Yu. Batalin.

The Commission's headquarters was established directly in the APS area. By 7 p. m. of April 26, the members of the Commission acquainted themselves with the situation





Water being checked in the Kiev Reservoir

and worked out a thorough program for rescue and relief operations. The main problem the Commission faced was evacuating the residents of Pripyat, the town where the personnel of the APS lived, and nearby villages and settlements.

Sizing up the radioactive situation in the APS and the adjacent areas and compiling a detailed map was attached top priority.

Ground and air radiation detection was begun at the same time. A specially equipped helicopter was allotted for the purpose, and the crew conducted aerial photography of the damaged area and checks of the radiation level. Obtained data were immediately processed for prompt evaluation of the situation.

One of the more urgent tasks was to elect a reliable procedure for the complete extinguishing of the reactor. Helicopters were used for this job too. Hovering over the damaged reactor, they dumped bags of sand, clay, boron, dolomite, limestone and lead into the "crater." It took several days to reliably stop up the death-breathing opening with five thousand tons of various materials. On May 23, the escape of radioactive substances to the atmosphere practically ceased — thanks to these and other measures.

The strategy and tactics of the recovery operations were permanently in the focus of the Commission's attention. Collective work was going on 24 hours a day, outstanding scientists, experts and administrators working as one close-knit team. One of the members of the Commission was Yevgeny Velikhov, Vice-President of the USSR Academy of Sciences. He made almost 40 helicopter flights over and around the destroyed reactor during his stay in Chernobyl, sometimes several flights a day. Only after he personally ascertained the facts would he report his observations and conclusions to the Commission and put forward suggestions.

On May 14, Yevgeny Velikhov told the journalists that the main danger had passed. "Up to this day, a large part of nuclear fuel and reactor graphite was red hot, which caused us considerable anxiety. The measures taken have allowed to substantially decrease the temperature inside the reactor, but another stage of work is still ahead. Decontamination of the total area and burial of radioactive substances will have to be conducted in very difficult conditions. The damaged reactor will be sealed off with a reliable protective structure, the designs for which are being developed here in Chernobyl."





Radiation control in the field

In those trying days, every one of the men engaged in the operations—ministers and scientists, workers and engineers, soldiers and militiamen—seemed to discover in themselves a previously untapped reservoir of courage, selflessness, responsibility, loyalty to duty and patriotism. The common struggle made the people stronger, hardened their will, and added a new dimension to their characters.

The situation at the APS was gradually improving. As a result of the measures taken, the temperature inside the reactor dropped considerably. Scientists presumed that the reactor graphite had practically stopped burning. Release of radioactive substances also decreased drastically.

Decontamination of the area of the APS, its buildings and structures, adjacent localities and roads was in full swing, with the latest in equipment and materials being used.

In those incredibly difficult days of May 1986, the people of Chernobyl were doing their utmost to tame the nuclear volcano, while the Communist Party and the Soviet Government took every step necessary to ensure successful elimination of the obvious and hidden consequences of the tragedy.

On May 2, Members of the Politbureau of the CPSU Central Committee N. Ryzhkov, Ye. Ligachev and V. Shcherbitsky visited the Chernobyl APS and were acquainted with

the situation by the Governmental Commission. The Commission also reported on the steps being taken to eliminate the consequences of the breakdown, normalize the situation in the adjacent areas, and conduct the resettlement campaign. The Members of the Politbureau visited a number of towns and villages, where they met with people evacuated from the affected areas, checked their living conditions and looked into the organization of medical aid, supplies, work of schools and kindergartens and distribution of jobs among evacuees.

In various stages of the operations, the Chernobyl APS was also visited by other Party and state leaders.

Late April and early May were the days of anxiety for all Soviet people. The *Pravda Ukrainy* newspaper wrote: "During April 30, work was under way at the Chernobyl APS in compliance with the program of operations. The radiation level on the territory of the APS and in the zone of the township has decreased 1.5—2 times. Decontamination of affected areas is in progress. Relief and rescue operations are conducted. Medical aid is administered to the victims. 18 of them are in grave condition. No foreign nationals are known to have been affected."

The tragic events at the Chernobyl APS filled the hearts of the Soviet people with grief and pain and taught the nations of the world a lesson of the grim realities mankind may encounter in its contemporary stage of development and the great responsibility everyone should feel for the future of civilization.

In his May 14 address to the nation on Soviet Television, Mikhail Gorbachev, General Secretary of the CPSU Central Committee, evaluated the situation at the Chernobyl APS and informed the Soviet people on the progress in the recovery operations. He also put forward a number of important suggestions, among them creation of an international security regimen in the development of nuclear power engineering on the basis of close cooperation of all countries, improvement of international relations and stopping the arms race.

On April 30 and May 1, the Ambassadors of Great Britain, France and the Netherlands and the Chargé d'Affaires of Austria were invited to the USSR Ministry of Foreign Affairs where A. Kovaliov, First Deputy Minister, on the assignment of the Soviet Government informed them of the situation.





Decontamination was conducted in deserted towns and villages

Speaking at the 40th Session of the United Nations General Assembly on May 1, the Representative of the Ukrainian SSR to the UN G. Udovenko extended gratitude to the UN Secretary General J. Pérez de Cuellar and all delegations which had expressed their sympathy in connection with the Chernobyl disaster. At the same time, he resolutely rejected the sensational, biased reports of the Western mass media, American in particular, on the accident and its consequences.

The Ukrainian representative also noted that the appropriate Soviet authorities had duly informed the IAEA on the accident and steps taken to neutralize its aftermath.

### FRIENDS IN NEED

Chernobyl is more than a national tragedy. These events were perceived by many people throughout the world as their own grief. The fight against the atom which had burst out of man's control made all people change their concepts of nuclear power, even if put to peaceful uses. Mankind received ample opportunity to imagine the scale of the catastrophe it would be plunged into should a nuclear war begin.

Most people abroad took the news of the ordeal which had befallen the Soviet people with sympathy, appreciating the energetic actions of the Soviet Government and local bodies of power. At the same time, we cannot disregard the attitude of governments, political figures and mass media of certain NATO member states, the USA in particular, to the Chernobyl events. Trying to capitalize on the grief of Soviet people, they launched an all-out anti-Soviet campaign. Newspapers were full of unimaginable concoctions about "thousands of victims," "communal graves," "dead Kiev," "burial of 15 thousand corpses as radioactive waste." That was how the *New York Post* commented on the Chernobyl events. *Paris Match* quoted "an unknown wireless enthusiast from Chernobyl": "Radiation killing hundreds of people. Explosions distinctly heard. Panic overwhelming. Thousands grab children and chattels and flee south to safety."

All that was nothing but an unprecedentedly base campaign of slander. Some people and newspapers in the United States and other countries were out to cash in on other people's grief. The case of a T. Garinka is very typical. Posing as author of a documentary film about the Chernobyl accident, he managed to sell the fake to several largest US



and Italian TV companies. Only after the police had suspected him of fraud and arrested him, Garinka confessed that he had purposely filmed a highly smoke-polluted industrial area in Trieste, Italy. This adventurer did not care a bit for somebody else's misfortune. Make money no matter by what means was his sole principle.

The fuss raised by numerous representatives of the American and Western European mass media in connection with Chernobyl had no basis in reality. Such was the conclusion the soberminded people in the West arrived at after an unbiased assessment of facts.

Certain statesmen and public figures in the USA and other NATO countries ungroundedly declared that the Soviet Union had withheld the truth about Chernobyl from the West. Contrary to all those allegations, the USSR furnished full and detailed information on the accident to competent international agencies as well as their representatives during visits to the APS. The Soviet mass media constantly kept the progress of the recovery operations in the focus of their attention. Newspapers of every caliber from Pravda to the smallest-circulation local newssheet gave their front pages to reports from the APS, describing the valuable contributions of various state agencies and public organizations to the common cause.

On April 28, the governments of a number of countries were offered information on the Chernobyl accident. Press conferences were held in Moscow. The Soviet radio and TV devoted much time to the developments.

Mike Davidow, the American People's Daily World's Moscow correspondent, visited the Chernobyl area. I know what anti-Sovietism in the USA is like, he wrote after the trip. However, this outburst of hysteria has no precedent. In the United States, the accident at the Soviet APS was taken as a pretext for a wave of malicious attacks on the Soviet Union. Its aim is clear as day: to convince the Philistine that the USSR cannot be trusted, that the real threat comes from the Russians. Along with my colleagues from central publications of the Communist parties of other Western states I was offered an opportunity to see the real picture of what had happened. No one tried to conceal the gravity of the situation from us. Soviet people told us frankly and honestly about the breakdown at Reactor No. 4. And we are thankful to them.

I was particularly moved, Mike Davidow noted, by my meetings with the people who were directly affected by the



Radiation supervisor Dmitry Dimov in a rare moment of rest



accident, the people who work at the station today and do their utmost to eliminate the consequences of the breakdown. We can call them real heroes. I talked to Vladimir Lyskin, an electrician, and asked him how he felt about the decision made by the Politbureau of the CPSU Central Committee to raise salaries for those working at the APS. He answered that money was not an end in itself and they were only doing what any Soviet people would do. In America, people won't believe that a worker doing such complex and responsible work under those conditions can be so unselfish in his thinking and actions. This young man helps me understand the entire history of the Soviet Union. Today he acts precisely like his father did at Stalingrad and Kursk in the time of World War II, like his grandfather in the Civil War as they defended Soviet power.

On May 21, 1986, the USSR Ministry of Foreign Affairs arranged a trip to Ukraine for senior diplomatic representatives of foreign states accredited in Moscow. They were received in the Council of Ministers of the Ukrainian SSR and apprised of the developments in Chernobyl. The Chairman of the Ukrainian SSR Council of Ministers informed the diplomats on the steps taken to do away with the consequences of the accident and ensure safety for the population and normal functioning of the national economy in the adjacent areas.

The heads of embassies had an opportunity to learn about the effort made on various levels to provide everything required for those engaged in the complex and sometimes dangerous work at Reactor No. 4.

On the invitation of the Soviet Government, Hans Blix, IAEA Director General, and a group of experts visited the USSR on May 5—9, 1986. They were taken to Chernobyl, where Soviet experts offered them detailed information about the situation in the reactor and the work being done. During the visit, ways were discussed to upgrade the safety factor in nuclear power engineering through the development of international cooperation in this field.

The anti-Soviet campaign fanned by the mass media in the West fostered all kinds of panicky rumors about the harmful effects of the consequences of the breakdown on the agriculture of Western Europe.

Consumption of certain locally produced foodstuffs was not recommended in the FRG and Italy, although in France, just a few kilometers across the border, no restrictions were imposed. Most probably, the French authorities had decided



In the control room of Power Unit No. 1

not to create any pretexts for panic because the share of nuclear power stations in the overall generation of electricity in that country amounts to nearly 70 percent. A well-known French scientist, H. Tazieff, noted in this connection: "A question arises: Why was the ban imposed on food imports from Yugoslavia while produce keeps on flowing in from Greece and Italy? Why does the ban apply to Poland but not to Finland or Sweden? I think it is francs, not roentgens, that matter."

Since May 9, 1986, seven Soviet meteorological stations have daily been providing the IAEA with information concerning radiation levels.

Experts in radiation safety met in the headquarters of the World Health Organization and arrived at the following conclusion: by May 6, 1986 the radioactive products above the European continent had dispersed and most of short-life radioactive isotopes decayed.



## THE EVACUATION

Referring to photographs taken by an American spy satellite, the Newsweek magazine alleged that on Tuesday, April 29, people still bathed in the Pripyat River and played football one kilometer from the burning reactor, which was supposed to mean that the residents of the town of Pripyat had not been evacuated. That was another lie.

The decision to evacuate Pripyat, the town in Chernobyl district, Kiev Region where most of the population were APS personnel and their families was made on April 26, 1986 immediately after the situation had been thoroughly analyzed and necessary consultations conducted.

Starting from 10 p. m. on April 26, buses and trucks began to arrive in the emergency zone for evacuating the people and their belongings. All in all, 1,100 buses and 200 trucks were concentrated in the Chernobyl area. Two diesel-driven trains were also prepared at Yaniv.

2 p. m. of April 27 was fixed as start-off time. At 1:50 militiamen knocked at the doors of every house and apartment and told people once again to get ready (a little earlier that information had been broadcast over the local radio). At 2 p. m. sharp a column of 1,100 buses entered the streets of Pripyat. Each driver knew the particular house and apartments he was supposed to take people from. In the span of two hours 40 thousand people—in fact, the entire population of the town—left the contaminated area. Those who still could not leave at once pulled up to militia stations where reserve buses waited for them.

The town became deserted. People had gone, but their houses and property were not left unwatched. Immediately after the residents had been evacuated, a guards service took over the houses and the property which remained there. Patrolling of streets was organized, too.

The buses carried evacuees to destination points, where people had already prepared to meet them.

After Pripyat residents had been evacuated, Party and administrative bodies, scientists and technical experts painstakingly analyzed the situation and came to the conclusion that it was expedient to evacuate people from everywhere within 30 kilometers from the APS, irrespective of the radiation level in any particular locality.

The first to leave were residents of the 10-km zone.



Forest Glade after-work sanatorium became home for many APS workers

The situation was far from simple on the jammed roads, but traffic militia were doing perfect work, displaying high professionalism and admirable composure. Their efficient actions helped organize a rather smooth progress of the huge column. Newly arrived buses and trucks were grouped without the slightest delay and directed to their destinations. Mobile filling stations were put up on the major crossroads. The population of the 10-km zone was evacuated on an emergency basis, but in an efficient and organized way.

At 3:30 p. m. on May 4, evacuation of people and their belongings and cattle from the 30-km zone was begun. In fact, it was the second stage of the operation which started on April 26.

Yevhen Kachalovsky, First Deputy Chairman of the Ukrainian SSR Council of Ministers, told Mike Davidow that in the territory of the Ukrainian SSR, 92,000 people and 50,000 head of cattle had been evacuated from the 30-km zone, which in itself illustrates the scale of the operation. A total of 2,172 buses and 1,786 trucks were engaged in it.

Throughout all stages of work in the contaminated zone, drivers showed high consciousness and professionalism. The distance they traveled cannot be measured by ordinary means. Be it kilometers or meters, they are marked with courage, fortitude and self-control.





Chernobyl children in a Young Pioneers camp at Belaya Tserkov

58 towns and villages of Chernobyl district, 10 villages of Polissia district (also Kiev Region) and 7 villages of Zhitomir Region were resettled in various towns and villages of the Ukrainian SSR.

The total number of evacuees from Ukraine and Byelorussia amounted to 116 thousand. After the evacuation had been accomplished, arrangements were made to tightly seal off the 30-km zone around the Chernobyl APS.

### **THERE ARE NO STRANGERS IN GRIEF**

Evacuation of people from affected areas resulted in an instantaneous growth of population in the towns and villages they were resettled to. Local residents readily accepted the newcomers and treated their problems with understanding. For some time they even shared their homes with them, helping them in every way they could. Local bodies of power took care of regular additional food-stuffs supplies.

The disaster drastically changed the life of the evacuees

and of those who still worked in the contaminated area. Everyone affected by the accident felt sincere care and sympathy on the part of all who surrounded them. As the saying goes, there are no strangers in grief. People living far from Chernobyl and the resettlement areas immediately responded to the evacuees' problems. Hundreds of parcels were sent by private persons and various organizations to Prip'yat and Chernobyl. The textile factories of Moscow, for example, sent 333,000 rubles' worth of presents. 297 parcels came from the women of various army garrisons. 4,240 cans of concentrated tea were delivered from the workers of the Poti tea factory in Georgia. 100 pairs of children's footwear arrived from the Andizhan shoe factory in Uzbekistan. Children's clothes came from the Tadzhik town of Zeravshan. Most frequently, this brief yet precise address was written on the parcels: "To Those Who Have Suffered From The Breakdown, Chernobyl." First-grade schoolchildren from Kuybishev on the Volga shared their toys, clothes and stationery. Other parcels contained dried fruit and herbs, books, vouchers for rest in sanatoriums and Young Pioneer camps, state loan bonds... People wanted to help what they could. Even today, money is still coming to Special Bank Account No. 904 which was opened to receive donations from work collectives, schoolchildren who have earned it by collecting scrap metal, members of students construction brigades and private individuals. Money is donated by pensioners, the Russian Orthodox Church, and foreign citizens. 500 million rubles were remitted to Account No. 904 in the first six months only.

Thousands of workers, peasants, engineers, army men, students, militiamen and intellectuals considered it their patriotic duty to contribute this way or other to the relief fund for the people of Chernobyl. Cash grants were distributed among evacuees immediately on arrival. In the very first days, the Trade Unions allocated 370,000 rubles for this purpose alone.

2,000 sets of clothes, 1,500 pieces of various sewed garments and 4,000 pieces of woolen knitwear — that was only one batch of clothing donated to the evacuees. Why so much attention to clothing? Nearly everyone had believed that the emergency period would not last long and they would return to their homes soon. Unfortunately, these hopes were not to come true...

The Kiev regional authorities distributed around 150,000 rubles' worth of clothes and household utensils and





Hans Blix, IAEA Director General, visiting Chernobyl APS

appliances free of charge. Retail trade directorates were instructed to sell goods to evacuees on credit and without the first instalment. During the first week after the accident, cooperative stores only sold 16 thousand rubles' worth of goods on credit and issued 16,400 sets of bedclothes, 3,800 beds and cots, 3,500 mattresses, 300 gas ranges, 62,000 rubles' worth of tableware and essential furniture, etc. The Red Cross Society allotted 2,565 thousand rubles in monetary aid to more than 51 thousand evacuees.

All in all, the evacuees received over 18.5 million rubles in lump sum allowances and nearly 157 million rubles as compensation for their material losses. Each family received an average of 15 to 30 thousand rubles. Construction of farm-type houses complete with utility buildings for the new settlers was commenced on a large scale. Nearly 50 thousand construction workers and engineers arrived from various regions of the Republic and set to work. The campaign was conducted at a very rapid pace, since the date of commissioning all those houses, hospitals, schools and kindergartens and trade centers was fixed at September 1. The builders were in a hurry because more than 90 thousand people had, with painstricken hearts, left their homes, fields, gardens, factories, schools and the graves of their

ancestors. The maximum of comfort had to be offered them in the shortest possible time. 12 collective and state farms, 14 industrial enterprises and 15 construction directorates had been relocated; over 42 thousand cattle, pigs and horses had been brought along from the contaminated area, and they had to be given some reliable shelter before winter too.

50 new villages were built for the evacuees in Ukraine. Dozens of various agencies did all in their power to ensure the earliest possible completion of the projects.

Most of the 11,655 houses left behind in the 30-km zone had no amenities, and one third of them required repairs. In the new villages and settlements, nearly 12,000 well-appointed houses were built.

Upwards of 200 million rubles were allocated for housing construction. Each farmstead cost an average of 30 thousand rubles. Nearly 200 trade and community centers, schools and sports grounds were built. In addition, a total of 7,500 new apartments in Kiev and 500 in Chernigov were allotted to the families of those who had worked at the APS and lived in Pripyat, and 10 thousand people were given temporary lodging in hostels. Besides, 6,000 houses were bought by the state from their owners in those areas in Kiev Region which had not been affected by the accident and transferred free to evacuees.

Temporary medical posts were set up in the villages which accepted evacuees. They conducted regular medical checks, advised people of the situation and issued relevant recommendations which were broadcast over local radio programs and published in newspapers.

A number of foreign diplomats accredited in Moscow visited some of the places the evacuees had been resettled to. They became convinced that the nearly 1,000 physicians and paramedical staff from other regions of Ukraine who were working there conducted highly qualified radiological examinations and laboratory tests, rendered adequate medical aid and ensured maintenance of proper sanitary conditions. 188 inspection stations and 38 mobile laboratories operated in Ukraine. Specially equipped airplanes and helicopters ensured comprehensive control of the radiation level and its effect on the environment.

Diplomats from more than 50 states visited the Maxim Gorky Collective Farm in Makarov district, Kiev Region. This is what Abdullai Amadou Si, Ambassador of the Republic of Mali, said in an interview: "This visit has undoubtedly





Armand Hammer, the American businessman and public figure, in Kiev

been very useful. I am certain that it will help 'decontaminate' some brains infected with the malicious disinformation which is being spread outside your country. The Soviet Union did and does its best to eliminate the consequences of the accident. The fuss raised by the Western mass media around the Chernobyl events boomerangs at those who are not willing to see the source of the real threat to all peoples — the threat of a nuclear holocaust. I fully agree with Mikhail Gorbachev's warning of the abyss which will yawn before humankind if a nuclear war befalls Earth. We all have to step up our joint struggle for peace before it's too late."

I can hardly imagine what would happen in the USA if an accident of this scale occurred there, said Mike Davidow. No one would give evacuees free shelter or food or clothes; no one would build new houses for them. In your country, the state has covered all the expenses. And we shall tell the truth about that to the people of America.

Getting a new start in life away from home, even if it is not from scratch, is no easy thing. But time heals wounds, especially when people treat somebody else's problems as their own, meet evacuees like dear guests and help them in every possible way to overcome the first difficulties and feel at home in their new place.

## THE SARCOPHAGUS

The victory over the fire on April 26 averted a catastrophic development of the breakdown and lessened its consequences. People were beginning to control the situation, but still it remained very dangerous. Water was now the main obstacle on the way to the damaged reactor. When the pipelines of the cooling system had burst, the water had found its way into the basin under the reactor and accumulated there in large quantities. The temperature inside the reactor reached into dangerous values and scientists feared that it might sag into the basin, all the more so that an enormous mass of sand, clay, lead, dolomite and other materials had by that time been air-dropped on top of the reactor. Should the red-hot contents of the reactor have touched water, the resulting steam would have exploded, ripping the building to pieces and throwing radioactive fragments of nearly 180 tons of fuel far around.

Several thousand cubic meters of water were to be pumped out from under the reactor. To reach the basin, special valves had to be opened, but reaching them through 1.5 meters of radioactive water proved impossible. Firemen started pumping out the water. To do it quickly, more than one thousand meters of hoses had to be laid through the zone of ejections of radioactive materials to the sump and a pumping station installed directly under the damaged reactor. Pumping out water turned into a very difficult operation, and it was conducted by topflight specialists according to a thoroughly thought-out plan.

Equipment ready, motors were switched on and the contaminated water flowed from under the reactor to special tanks.

For two full days on end, firemen and teams of volunteers took turns pumping off the radioactive "lake".

After they had finished, supply pipelines were laid underground, and liquid nitrogen was fed to the crippled reactor at the rate of 25 tons per day. Its temperature being  $-198.5^{\circ}\text{C}$ , it cooled the reactor's bottom and frosted the soil under it, which reliably protected underground waters from contamination.

A thick concrete baseplate was to be placed under the reactor to become the foundation of a protective structure



popularly called the sarcophagus. An entrance pit was excavated, and miners from the Moscow and Donetsk coal-mining areas and Kiev subway builders started digging a tunnel to the reactor. Pneumatic hammers were their only tools, since the size of the tunnel did not permit to use tunneling machinery. Meter by meter they cut into hard soil, filled mine cars and rolled them out to the surface, where dump trucks were waiting to carry the contaminated soil away for burial.

The miners' selfless efforts allowed to accomplish the tunnel and install the six-meter-thick baseplate even before the time set by the Governmental Commission.

Neutralization and interment of the damaged reactor, a dangerous source of radioactive contamination, was going on 24 hours a day. Construction of the sarcophagus was nearing its end, and at the same time metal frameworks were welded on the outskirts of Chernobyl for its biological protection walls.

With decontamination in full progress, the radiation level at the APS and in the adjacent areas was steadily decreasing. That allowed to begin — back in May, simultaneously with the building of protection facilities — preparatory work for recommissioning power units Nos. 1 and 2. The task was to have both units, 1 million kWt each, running before winter, and without the slightest harm to the health of people and the environment.

The Governmental Commission organized further decontamination of the 30-km zone, its residential buildings and industrial enterprises. A 20-centimeter-thick layer of soil was sliced off by bulldozers from the territory of the APS, and steel containers were filled with it and buried. Firemen sprayed trees with special solutions, helicopters decontaminated the nearby forests.

Dosimeter service controlled the radioactivity level throughout all affected areas — towns, villages, water and soil. Once every three hours, the meteorological station in Oster, Kiev Region made detailed reports on radiation levels, wind direction and velocity, air temperature and atmospheric precipitation. All these data were immediately conveyed to the IAEA.

More remote-control equipment appeared around the APS. A 18-ton bulldozer was airlifted from Chelyabinsk in the Urals by an IL-76 cargo jet to Kiev, where it was equipped with radio control, and brought to Chernobyl. It was used to shovel radioactive debris to the walls of the dama-

ged reactor which would later have to be buried under the ferroconcrete sarcophagus.

Before the erection of the protective structure had begun, the scientists required the precise values of temperature on top of the debris-covered reactor. Helicopter crews were assigned this task. An 18-meter-long pipe crammed with various sensors was installed in the "crater" and cables connected for a continuous flow of information. Acting blindly was too risky. Aerial photographs were taken and thoroughly studied. Several spots were chosen for the pipe. Three helicopters flew to the "crater", two correcting the actions of the third. The helicopter piloted by Mikola Melnik hovered above the reactor then sharply descended. Only the third attempt was a success, and the pipe was installed right in the required place. Later, cables were connected to the master line and information on the reactor's condition started coming in.

Maximum safety of people was to be insured for carrying out the main task — the erection of the protective structure. That required a complete removal of the radioactive debris and decontamination of the roofs above the third power unit and other structures.

By that time almost all of the station's area had been decontaminated, but work on the roof, the "dirtiest" place, had not yet even begun. Covered with a thick layer of radioactive dust, large pieces of concrete and fuel scattered by the blast, the roof remained the most dangerous place. Before starting any work on it, the radiation level of every little section had to be determined, because men would be working there. Remote-control equipment, and some of it was imported from West Germany and other countries, would not serve the purpose: its electronic circuits went out of order under the effect of radiation. Only man could do the job... There was no lack of volunteers, but only one was required. Alexandr Salayev, lieutenant colonel of medical service, was selected.

The entire dosimeter control team took part in preparing Salayev for the operation. Physicians and physicists looked into every minute detail. Nothing could be underestimated or overlooked. A specially designed suit was put on him — the work clothes which, hopefully, no one else will have to wear on Earth. A physically strong man, he stood among his friends in his armored outfit, covered from head to toe with all kinds of sensors and gauges.



Salayev made the first cautious step, the second, and walked confidently on. He went to meet the invisible but already well-known enemy face to face. What he would do was vitally important to ensure the ultimate success.

And Salayev did it. Sensitive instruments registered his every step. The picture was being drawn, inch by inch, for those who would later follow the trailblazer.

All the instrument readings were transferred onto special maps, without which work on the roofs could not be started. The cleaning operation required courage, caution and self-possession from everyone engaged in it.

They had to clean 1,500 square meters of roof area. Broken railings were scattered all over it. In addition, the once molten bituminous coating had solidified after the fire and a lot of radioactive fragments remained imbedded in it. Therefore, the coating had to be scraped and torn off. The partition wall between the third and fourth power units had to be blown up so that the debris could be dumped down from the roof.

All men of the special decontamination group were engaged in the cleaning. Necessary safety measures were taken. Prior to the decisive stage of the operation, an experiment had been conducted to determine the safest and fastest way to remove the "dirt". A time trial was performed and each step a man would have to make in the highest risk zone thoroughly discussed. Seconds only were at their disposal, and their actions were watched on TV screens and monitored. The main task was to remove the larger pieces of fuel and concrete. In the more open spaces, tractor robots were used. Their sophisticated electronics had been replaced with "ancient" but reliable relays. The entire group of scientists working in Chernobyl was involved in the operation.

After the cleaning had been accomplished, erection of the "sarcophagus" began. It required further concerted efforts of scientists, engineers and workers. It was supposed to be not only a concrete tomb, but an engineeringly complex structure which could ensure comprehensive control of the situation in Reactor No. 4. At the same time with its concrete foundation, a partition wall was built to cut the enormous building from top to bottom between the third and fourth reactors, as the former was practically undamaged by the breakdown.

Special attention was paid to ensure safety of the builders. The bulk of work was done outside the Reactor No. 4

area. Prefabricated structures were shipped in from Kiev by the Dnieper and the Pripyat and assembled into sections, which laid foundation for the most massive wall of the tomb. Each stage of construction called for original decisions, inventiveness and, no doubt, the highest of professionalism from all engaged.

Demand for concrete was growing. Large quantities of it were consumed by the eight-meter-thick protective wall and the roof surfaces from which the "dirty" upper layer had been removed.

Three concrete mixing plants built within 20 days continuously supplied concrete to the site 24 hours a day, producing a daily average of 5 thousand cubic meters. Crushed stone, gravel and sand were delivered by barges to the Chernobyl river port, cement was supplied from Teterev, a district center in Kiev Region. A two-stage delivery system also functioned smoothly. Dump trucks carried concrete from the batching plants to a scaffold bridge on the boundary of the contaminated area, where it was dumped into a bunker and then to a concrete mixing truck right under it. Thus, the "contaminated zone" trucks did not leave its limits. This system allowed to avoid radioactive contamination of the roads, vehicles and batching plants.

A two-stage method was used in transporting people. For some time work shifts were brought to the site in armored personnel carriers whose plating lessened radiation by half. Since working time was limited by the doses of radiation people received, it was essential to minimize the effect of radioactivity during travel. Later, the Lvov Bus Factory manufactured a number of special buses sheathed with lead plates. Their window glasses were coated almost to the top with radioactivity-resistant compounds. In the windscreen, only a small road-view window was left for the driver. The workers used ordinary transport to get from their homes or dormitories to transfer points, from which the lead-plated buses brought them directly to the site.

The "sarcophagus" was growing rapidly. A giant of a crane placed enormous pre-assembled metal structures with steel lattice girders inside into the wall. Each girder was to be filled with 40 cubic meters of concrete. A powerful concrete pump, mounted on a truck chassis and equipped with a 50-meter-long delivery hose, was used for that purpose. Every five minutes a new mixer truck "docked" with the pumping aggregate.



One could realistically assess the scale of destruction and of work to be accomplished only standing there on the construction site.

After concreting each tier of the huge pyramid, the pump was raised higher. To the upper ledges concrete was delivered by pipeline, and in the final stage, when the "sarcophagus" was being roofed, a self-tipping bucket conveyor transported concrete to the height of 60 meters.

And then came the long-awaited day of sealing off the "sarcophagus". The most critical period of the recovery operation was coming to its end.

Top-class organization of construction coupled with the courage and selflessness of people did it. The reactor was reliably immured in concrete. Erection of this gigantic, technically complex structure had required assembling and mounting 7 thousand tons of steel structures and placing 410 thousand cubic meters of concrete. A steel beam weighing 165 tons and which the builders called "Mammoth" was lifted to the height of 58 meters. Less than within a month 150 1,800-mm pipelines were laid through the power unit's walls and innards. This ventillation system is the lungs of the damaged reactor. Its "breath" is reliably purified by filters, which keep radioactive dust inside the walls of the "sarcophagus".

In less than six months the people who had come to Chernobyl from all over the Soviet Union did an enormous amount of work. Undoubtedly, the interment of the reactor is the more impressive stage of that campaign. However, the scale and rate of housing construction — nearly 12 thousand houses for evacuees from the danger zone and townships for those who work at the Chernobyl APS today — as well as of building the Pripjat river terminals and tens of kilometers of motor roads are also worth admiration.

Yet, health and safety of people remained priority number one.

---

### RADIATION AND MEDICINE

The natural radiation background has existed for thousands of years. The intensity of ionizing radiation a person is permanently subjected to depends on the locality where he or she lives. The average natural radiation dose accepted by scientists as base value equals



Dr. Robert Gale (USA) visiting the Republican Children's Clinic in Kiev

100 milliroentgens a year. In certain parts of the world, the natural radiation background is higher than the average. For example, in the Indian state of Kerala, Brazil, and the Central Granite Massive in France it is 5—6 times the average, which has no adverse effect on local residents.

In addition to the natural radiation background, people receive certain doses during X-ray examinations. These doses also vary in different countries — from 140 milliroentgens a year in the Soviet Union to 160 in Poland to 180 in Japan.

Apart from that, people's living in houses adds another 150 milliroentgens, because some radioactive elements are always present in construction materials.

These three components make up the average annual dose a person gets. It varies from 350 milliroentgens a year in the countryside to 500 milliroentgens in large cities. Like in other highly industrialized countries, the average lifetime dose amounts to 25—28 roentgens in the USSR.

Occupational radiation doses for APS personnel average 19—25 roentgens for 25 years of work. 25 roentgens a year is the dose accepted as safe by all international committees and agreements. Occupational radiation doses are determined with large safety margins, and receiving a dose of this order is an exception.



Radiation sickness can develop in case a single dose received exceeds 75—100 rems (the rem is a medical roentgen equivalent; 1 rem of X-radiation equals 1 rad of received dose, and the rad is a unit of ionizing radiation received by the whole body, while received dose is the energy of ionizing radiation per unit of mass of the substance exposed to radiation). Such effects as cancer and genetic disorders are considered inevitable at more than 100 rems.

The Chernobyl events have brought these calculations from a hypothetical plane down to harsh reality. Yuri Shcherbak, M. D., a known Ukrainian author, visited the emergency zone in the first days after the accident. He wrote: "We were given ample opportunity to peer beyond the far side of the night, the night which will fall if nuclear warheads start exploding. Be it my will, I would bring all political leaders who oppose detente to Chernobyl — let them see, think and decide before it's too late."

Here is part of a document called "service report" in the office language. The writer, Andriy Polovinkin, an ordinary fireman, describes how he and his friends fought the fire on April 26. Toward the end of the writing lines went aslant: he had gotten tired...

"...We arrived on the scene three minutes later and started uncoiling the hoses and get ready for extinguishing the fire. I rose to the roof twice to pass brigade commander's orders. Personally, I want to note the courage of Lieutenant Pravik who, though fully aware of the huge radiation dose he had received already, still went into that inferno and reconnoitered every detail there. I can also note Ivan Shavrey, Leonid Shavrey, Olexandr Petrovsky, Bulava... I can't say much about the others because the fire fighting had still been going on when I was taken to hospital."

Ionizing radiation and fire killed Sergeant Mikola Vashchuk, Senior Sergeant Vasil Ignatenko, Lieutenant Viktor Kibenok, Lieutenant Volodimir Pravik, Sergeant Mikola Titenok and Sergeant Volodimir Tishchura. Each and every means at the disposal of medicine and what donors could give — blood and bone marrow — were used in an attempt to save the lives of the heroes who had shielded their near and dear ones and many, many other people from the invisible death.

Six firemen died of sustained injuries and radiation sickness. Fortunately, the lives of other fire fighters were saved.

All in all, 300 people were hospitalized after the breakdown. The diagnosis for over 200 of them was acute radiation

sickness of various degrees. On April 27, 129 were flown to Moscow by three chartered flights. Those were the more critical cases who required very special treatment and attendance. The death toll of the accident is 31 people. 28 of them died of acute radiation sickness.

Thorough examination of several hundreds of thousands of people from nearby towns and villages revealed that no one had symptoms of radiation sickness. Nevertheless, strict medical control was imposed.

The Ministry of Health was one of the first to receive the signal of disaster from Chernobyl. In a matter of hours a sufficient number of physicians and paramedical staff was assembled in the Chernobyl area to perform both preventive checkups of all those whom the breakdown had overtaken near the APS and render medical assistance to those who needed it on the scene of accident. As of May 8, more than 1,300 doctors, nurses, laboratory attendants, and radiation supervisors and 240 ambulances worked in the Chernobyl APS area.

Under the conditions of an increased radiation background it was essential to ensure effective control of how radiation safety rules were observed by all those working in the area, provide continuous and comprehensive dosimetric and sanitary control and organize adequate medical assistance to the victims of the disaster.

One of the first steps the medical authorities had to take was to prevent the adverse effect of the radioactive isotopes of iodine, which is characteristic of accidents accompanied by ejections of radioactive substances to the atmosphere. It was very important to provide all local residents with stable-iodine preparations without delay. This was done. The Soviet doctors took into account the lessons of the Three Mile Island accident in the USA, where this medicine had not been distributed until the end of the fourth day after the breakdown.

The major concern of the medics was the possible effect of radiation on children, first and foremost those who were born after the accident and those yet unborn. From May to September 1986, one hundred healthy infants were born in the high-risk group of mothers. The personnel of the Ukraine cardiological sanatorium were to handle a whole lot of problems after it became home for the mothers and infants and expectant mothers evacuated from the 30-kilometer zone. In several hours, it had been prepared to welcome the unexpected guests. In addition to rendering highly





Musaffir Salam, correspondent of Kuwaiti newspaper Al-Aiba, decided to go through a radiation inspection together with residents of Makarov district, Kiev Region

qualified medical aid, the personnel did their utmost to create a really homelike atmosphere for their patients.

Stringent control was imposed on the quality of food-stuffs. The closer to the breakdown area, the stricter food control. All agricultural produce brought to markets and shops was thoroughly checked.

Some of the open-air markets were temporarily closed in Kiev, and dosimeter inspection introduced in the large roofed markets. Dairy products were subjected to double checks — at farms and at dairy factories. If a batch of milk proved contaminated with radioactive iodine, it was immediately directed for cheese and butter production, consumption of which poses no danger. Moreover, the highest permissible iodine-131 content in food by the USSR standard is ten times lower than a British standard permitted after radioactive iodine isotopes had been ejected to the atmosphere as a result of a nuclear reactor accident.

From the first days after the breakdown, the residents of Ukraine, scientists, and all those who simply love to spend their vacation on the Black Sea coast were concerned over the water problem. In order to prevent radioactive conta-

mination of the Kiev Reservoir, into which the Pripjat River falls, and the Dnieper which is a source of drinking water for millions of people and empties into the Black Sea, earthen walls were raised along the banks of the Pripjat.

The complex situation posed several problems at once. Within a month, a standby pump station was erected to ensure continuous water supply to Kiev from the Desna River. 58 artesian wells from 160 to 330 meters deep were drilled in various parts of the city. Artesian water was used by all Kiev milk factories. Yet, there was danger of contamination spreading by underground waters from the immediate Chernobyl area. Wells were drilled and the directions of underground streams changed to divert them from the contaminated zone.

Luckily, the Kievans did not have to switch to artesian water. Samples were taken every hour, the tests showing that the content of radioactive elements in the Dnieper water presented no danger whatsoever.

Kiev has always been known as a clean green city of parks and gardens. For the period of recovery operations in Chernobyl, still stricter sanitary rules were introduced in the city. Roads, sidewalks and yards were washed more often than usual. Radiation detection posts were stationed at all entrances to the city. If a contaminated vehicle was detected, it was immediately directed to a decontamination outpost.

Scientists, medics and the mass media did a very important job helping people cope with the situation they never had faced before. On the one hand, spreading wild rumors had to be checked, and on the other, an earnest and practical attitude toward radiation worked out. The large number of physicians engaged in the elimination of the consequences of the breakdown included the best Soviet and foreign experts. Robert Gale, professor at the University of California and a leading expert in bone marrow transplantation, displayed particular concern and readiness to help. Armand Hammer, the well-known American businessman and public figure, said later that as soon as he had learned from Dr. Gale about his intention to go to the Soviet Union, he immediately cabled Mikhail Gorbachev, and an invitation followed at once. Later, when orders for various medicines and equipment began to come from the scientist, many countries responded promptly and positively.

Professor Angelina Guskova, a leading Soviet expert in treating the radiation sickness, handled the most serious



cases in a Moscow hospital. She said that prior to the arrival of the American colleagues, bone marrow had already been transplanted in six patients. The first decisions and operations were made by Soviet doctors. When the American doctors arrived, the work had already been in progress and they continued it together with their Soviet counterparts. The presence of topflight experts with their rich experience was useful, though far from all cases were handled jointly.

Prof. Guskova spoke highly of the human and professional tact of Dr. Gale and his colleagues. Every time opinion was split on an assessment or prognosis, Dr. Gale would cut the debate short with a diplomatic, "Stop. Discussion over. We do as our hosts do."

Judgment told Soviet doctors that it was necessary to limit the participation of foreign experts in treating radiation sickness patients. Many foreign specialists were persistent in their demands to be allowed to participate. Many firms sent their drugs. However, it was inadmissible to have three doctors, foreign or not, standing behind the back of the one who was actually handling a case. Obviously, they would have only interfered with urgent work. Only tried medicines were prescribed, too. A sick man is no test tube in which every new drug produced may be tried.

The joint work of Soviet and American doctors in the summer of 1986 gave them to feel how fruitful their cooperation could be, offered them a glimpse of a future in which the health of man is cared for by the whole friendly world.

"I am sure," said Dr. Gale, "that should it happen in any other country, Soviet doctors would immediately offer their help too."

At the press conference in Moscow on May 15, 1986, Dr. Gale noted the high efficiency of Soviet medical institutions and the competence of their personnel. "I'm not afraid to say that these people performed a heroic deed, they risked their lives to save their compatriots," said the American scientist.

Apart from rendering aid to those who had suffered in the breakdown and immediately after, doctors had to find out the possible extent of the effect of radiation on the residents of nearby towns and villages. Jointly with other organizations, health services determined the limits within which the health of people might be endangered. The USSR Ministry of Health made a decision to examine all those who had been exposed to radiation in any degree or had applied for medical help. Nearly 230 medical teams were deployed

for that purpose in various places. By the end of May, over 220 thousand people had been thoroughly examined.

Qualified medical aid was given to everyone who needed it by the best doctors. It was very important to return to people their psychological stability. On the other hand, local residents actively helped medical personnel set up and equip medical and decontamination posts and other services required for their work.

During the year that passed after the breakdown, over one million radiation detection tests were made. The state of the air, water, soil, foodstuffs and raw materials was under permanent control, which allowed to forecast that by May 1987, the gamma background in Kiev would decrease to 0.03 milliroentgens per hour throughout the city and reach pre-Chernobyl values (from 0.015 to 0.04 milliroentgens per hour). This prediction proved correct.

Today the medics are tackling new tasks. Continuing to do their utmost to protect the health of those who suffered as a result of the breakdown, they concentrate on possible side effects which may still manifest themselves as well as on preventive care and scientific research. A nationwide center of radiological medicine was created in Kiev to promote research in this vitally important sphere.

The first year after Chernobyl enabled doctors to gather and process information on the first thousand babies born after the breakdown. They did give the obstetricians some trouble: weighing an average of 4 kg, most of them were heavier than babies born under normal conditions. As a rule, obstetricians do not like that. Nor are mothers more comfortable for the excessive weight, which in this case was accounted for by the fact that immediately after the breakdown the Chernobyl expectant mothers had been put under strict medical observation. A high-calory diet and change in the very mode of life resulted in the increased average weight of the newborn.

True, this is by no means to say that radiation is a rather safe, medically controlled phenomenon. At the same time, radiation is different from harmful chemicals in that to predict its effect on the human organism, doctors have at their disposal verified charts of correlation between the dosage and possible consequences. Therefore, their predictions are based on the strict interdependence of the radiation dose and the extent of risk, and not on intuition.

The estimated increase in cancer cases among residents of the areas where contamination was the worst is from





Inaugurating the village of Ternopolskoye in Makarov district, built for evacuees from Chernobyl

one to one and a half percent. The Soviet delegation adduced this estimate to the extraordinary session of the IAEA in Vienna in the autumn of 1986, and this figure remains in force today, although it was based on the most unfavorable assumptions. It has become clear after a more detailed and precise measurement of the doses the local residents received that the original data used in previous computations were greatly exaggerated — from five to ten times in some areas. Therefore, the figure of 1—1.5 percent is even likely to decrease.

However, all this is no reason for self-complacency. In the spring and summer of 1987, medical agencies exercised intensive control over the safety of foodstuffs. The medics supervising workers in the APS area are not going to lessen their efforts either. The so-called radiation registry system covers nearly 100,000 people. They are all classed into groups and will be examined approximately once a year apart from regular general checkups.

The Chernobyl accident could not possibly cause radiation sickness in other European countries. According to experts, the largest dose of radiation a person could receive there does not exceed the space radiation dose an airplane passenger gets during a Paris — Los Angeles — Paris flight.

## THE LESSONS OF CHERNOBYL

This century is correctly called the Nuclear Age. More than 370 nuclear reactors function in various parts of the world today. This is reality, and the future of world economy is hardly conceivable without nuclear power engineering. 40 reactors function in the USSR. Their collective capacity exceeds 28 million kilowatts. Mankind derives considerable benefit from the harnessed atom.

However, even peaceful uses of nuclear energy are fraught with danger. Accidents at nuclear power stations are dramatic proof of that. All countries where nuclear power plants are run should pool efforts to find ways and means of excluding chances of further breakdowns. According to a confidential document made public by US Senator Glenn, 151 breakdowns occurred at nuclear power stations in fourteen countries from 1971 to 1984. Senator Glenn defined an APS breakdown as including a considerable exhaust of radioactive materials and having its effect on the health of people.

Given below is a brief list of accidents at nuclear power stations in the USA.

June 24, 1959. Partial meltdown of fuel components, which developed after the cooling system failed in the research reactor in Santa Susanna, California.

January 3, 1961. Steam blast at the research reactor near Idaho Falls, Idaho. Three people died.

October 5, 1966. Partial meltdown of the reactor's active zone as a result of a cooling system failure at the Enrico Fermi reactor near Detroit.

November 19, 1971. Nearly 200 thousand liters of water contaminated with radioactive materials flowed from the overfilled waste storage pool of the nuclear reactor in Monticello, Minnesota into the Mississippi River.

August 7, 1979. Nearly 1,000 people received radiation doses five times the norm as a result of an ejection of highly enriched uranium at the fuel-producing factory near Irving, Tennessee.

January 25, 1982. Radioactive steam was ejected to the atmosphere as a result of a steam generator pipe burst at an APS near Rochester, New York.

But the most serious breakdown occurred at the Three Mile Island nuclear power station in Pennsylvania. At 4 a. m. on March 28, 1979 the cooling system of Reactor No. 2



went out of order. Hydrogen began to accumulate, threatening to explode any moment. Three days passed before it transpired that the APS management had deliberately given instructions to release radioactive gases to the atmosphere, having informed neither local nor federal authorities. On March 29, 1.4 million liters of radioactive water were discharged into the Susquehanna River. Dosimetric control was not begun until four days later. A panic could not be avoided. The US Congress was not notified until ten days, other countries — until two months later.

And yet the Americans and their allies decided to use the tragic events in Chernobyl to fan anti-Soviet hysteria. They demanded a report on the accident on the very following day.

The Chernobyl accident was the most serious of all known so far. Assessment of what had happened required quite some time. As soon as it became possible, the Soviet Union supplied all necessary details to appropriate international agencies.

The masterminds of this abhorrent anti-Soviet hullabaloo tried to present the Chernobyl accident as a worldwide nuclear holocaust. But their efforts yielded unexpected results. They made people think of the danger a nuclear catastrophe as such entails. The events of several weeks after the accident dashed certain Western politicians and propagandists' hopes of getting peoples to reconcile themselves with the nuclear threat and the thought that they could live safely with 50 thousand nuclear warheads.

A breakdown or accident is next to nothing compared with the threat of a nuclear war. This is one of the lessons of Chernobyl which helped people understand the extent of irrationality, absurdity of the very concept of the "survivable" nuclear war, be it a large-scale or a "limited" one.

The scale of the Chernobyl disaster can in no way be compared with a nuclear blast. Any nuclear explosion would bring much more disastrous consequences. But the accident once again demonstrated to the whole of mankind how dangerous nuclear energy is when it bursts out of man's control. The grave consequences of the accident lent additional weight to the responsibility of all states in the cause of averting war.

With the scientific and technological revolution taking greater strides every year, the issues of reliability and operational safety of equipment as well as discipline and order acquire paramount importance. This is another indispu-

table lesson of Chernobyl. Analysis of the breakdown showed that gross infractions of operational rules by personnel had been its principal cause.

The first serial RBMK-1000 reactor was commissioned at the Leningrad APS back in 1973. Neither that reactor nor any other of its type have ever presented any problem. Channel-type reactors like the RBMK-1000 are more reliable than the traditional shell-type ones. RBMK-1000 reactors are equipped with a number of safety devices and systems designed to counter any emergency and within a short time prevent the consequences of any thinkable failure in the sophisticated system of the station.

Nevertheless, the breakdown occurred at the power unit commissioned in December 1983. Its functioning was quite satisfactory up to the very breakdown. After two years of continuous operation it was to have been shut down for scheduled maintenance. But before the shutdown, the APS management decided to carry out an experimental trial on one of the turbogenerators. The quality of the test program proved to be low. The experiment was wrongly conceived and incorrectly organized. It was not agreed either with representatives of the chief designer of the reactor or the chief designer of the APS, or the nuclear safety officers permanently stationed at the APS. All the multiple safety interlocking systems and sophisticated technology and equipment could not have protected the station from utter irresponsibility, lack of order and carelessness. The more powerful and complex the equipment we use, the higher the price we pay for our errors in the subtle relationship of man and the machine.

At the same time, the Chernobyl accident brought to light another important aspect of the problem — the role of the human factor and the moral potential of people who found themselves in extraordinary, critical circumstances. With almost all of the participants in the recovery operations, their mental anguish over what was going on became the source of courage rather than despair, and rugged determination rather than impotent listlessness.

Estimating the situation one year after the accident, Hans Blix, Director General of the IAEA, said that on the one hand, the disaster had been caused by absolutely incredible errors on the part of the APS personnel; on the other, as soon as the accident occurred, the Soviet experts engaged in eliminating its consequences displayed exceptional competence and professionalism. The heroic actions of the firemen



deserve the highest praise. Many of them gave their lives. On the next stage the advantages of a state having centralized planning were obvious. The very fact that huge resources, both material and intellectual, and all organizations concerned were engaged within such a short period of time speaks for itself. "I can't say I support centralized planning in all situations, but in this particular case it showed its advantages," said Mr. Blix.

The lessons of Chernobyl have been taken into account in the USSR. Additional measures were introduced to ensure safe functioning of nuclear power stations, including perfection of nuclear power engineering machinery and technology and upgrading the professional level of personnel. In the international arena, the Soviet Union put forward important initiatives aimed at creating international modalities for safe nuclear power development.

Richard Wilson, a physicist at Harvard University, warns that the lessons of Chernobyl are not readily absorbed at all nuclear power stations in the world. The Soviets have begun retraining their atomic stations' personnel and intend to increase the number of control rods in reactors by 30 percent to minimize the chance of an uncontrolled nuclear fission, says he. But as far as is known, no other country has introduced such changes.

M. Brown's front-page article in *The New York Times* points out that despite the worldwide concern caused by the Chernobyl disaster, experts say that it has not led to any serious technical change in nuclear power engineering in the West.

In its report based on data of the US Governmental Commission on Nuclear Control, the Public Citizen Research Agency proved that upwards of 93 thousand Americans working in the nuclear power industry were exposed to radiation in 1985.

The French newspaper *Quotidien de Paris* wrote recently that a report had been published in France on the unsatisfactory state of the country's nuclear power engineering. Malfunctions at the uranium processing factory in Pierrelatte and the APS in Creys-Malville proved that.

Nevertheless, even one year after the Chernobyl accident the Western mass media do not abandon attempts to accuse the USSR of concealing information and producing unreliable reactors, although the two-volume report submitted to the IAEA in September 1986 was recognized as exhaustive

and many experts of this authoritative agency confirmed that Soviet-made reactors were sufficiently reliable.

Since the Chernobyl events, the Soviet Union has done more than any other country to promote the widest possible international exchange of information in the field of nuclear safety. This contribution of the USSR refutes the anti-Soviet stereotypes imposed on the public by opponents of international cooperation. The new way of thinking which was brought about by the Chernobyl tragedy emphasizes the necessity of peaceful cooperation of peoples for averting the threat of a nuclear catastrophe.

"The nuclear age," said Mikhail Gorbachev, "forcibly demands a new approach to international relations, the pooling of efforts of states with different social systems for the sake of ending the disastrous arms race and radically improving the world political climate. Broad horizons will then be cleared for fruitful cooperation between all countries and peoples. This will benefit all people on Earth."

Everyone should clearly understand that the main threat to our planet comes not from the almost 400 nuclear power stations functioning in many countries of the world, but from the 50 thousand nuclear warheads accumulated in war arsenals.



Василий Иванович Нибак

**ЧЕРНОБЫЛЬ:  
ПРАВДА И ВЫМЫСЛЫ**

(На английском языке)

Перевод с русского  
Валентина Львовича Маркелова

Художник  
Юрий Георгиевич Новиков

Киев  
Издательство политической  
литературы Украины

Translated by  
Valentin Markelov

Photos by Igor Kostin; RATAU

Chief of editorial staff Yu. Kholodkov  
Editor S. Sinhayivsky  
Junior editor N. Serguienko  
Cover design Yu. Novikov  
Cover editor V. Maryniak, K. Skuratova  
Proofread I. Gumeniuk

Информ. бланк № 5082

Сдано в набор 30.07.87. Подписано в печать 14.09.87.  
Формат 84×108<sup>1</sup>/<sub>32</sub>. Бумага типогр. № 1. Гарнитура жур-  
нальная рубленая. Печать высокая. Усл.-печ. л. 2,52. Усл.  
кр.-отт. 4,53. Уч.-изд. л. 2,314. Тираж 4000 экз. Зак. 7—2349.  
Цена 15 к.

Политиздат Украины,  
252025, Киев-25, Десятинная, 4/6.

Головное предприятие республиканского производственно-  
го объединения «Полиграффинга», 252057, Киев, ул. Дов-  
женко, 3.



